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V. A STUDY OF PERSONAL AND MILITARY BACKGROUND FACTORS RELATED

TO MARKSMANSHIP IN THE MARINE CORPS RESERVE (GROUND)

A STUDY OF PERSONAL AND MILITARY BACKGROUND FACTORS RELATED

TO MARKSMANSHIP IN THE MARINE CORPS RESERVE (GROUND)

Technical Report V — Project on

TRAINING PROBLEMS IN THE MARINE CORPS RESERVE

Office of Naval Research Contract NONR 1654(00)

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International Research Associates

PREFACE

The data developed in this report were collected as a by-product of controlled experiments conducted in order to evaluate training methods in selected Marine Corps Reserve (Ground) training center ..

Reports submitted to the Office of Naval Research by International Research Associates, Inc. in fulfillment of the principal objectives of the project, are as follows:

Report I: An Experimental Evaluation of Preliminary Marksmanship
               Training in the Marine Corps Reserve (Ground)

Report II: A Set of Objective Tests of Map Reading Ability for
               Use in the Marine Corps Reserve (Ground)

Report III: A Basic Lesson Plan for the Teaching of Map Reading
               in the Marine Corps Reserve (Ground)

Report IV: Experiments on the Use of the Basic Lesson Plans for
               the Teaching of Map Reading in the Marine Corps
               Corps Reserve (Ground)

I. INTRODUCTION

A. The Purpose

The purpose of this study was to identify among selected personal and performance characteristics of enlisted members of the Marine Corps Reserve (Ground) those characteristics which are: (1) significantly related to marksmanship with the .30 Cal. Rifle; and (2) determinants of marksmanship.

A characteristic was considered significantly related to marksmanship if the relationship could not occur more than five times in one hundred on a chance basis alone. A characteristic was considered a determinant of marksmanship if the characteristic could explain at least 50 per cent of the variance of marksmanship scores.

The factors which are determinants of marksmanship may be relied on to predict future success or failure in marksmanship among new recruits.

B. The Data

The following data were taken from the official records of the Marine Corps Reserve (Ground) during January of 1956:

1. Marksmanship, measured by the most recent qualification score posted by the man on the .30 Cal. range. In most cases the score was obtained during summer camp training in 1955.

2. Military rank.

3. Age.

4. Education, measured in years of school completed at the time of the current enlistment.

5. Intelligence, measured by the score on the AGCT.

6. Attendance, measured by the percentage of drills attended since the time of the current enlistment.

7. Conduct, measured by officers' rating.

8. General Proficiency, measured by officers' rating.

C. The Sample

The sample consisted of every member of the Marine Corps Reserve (Ground) in the New York area for whom all of the data listed above were available. The sample size was 559. The characteristics of the sample are given in Table I which follows:

TABLE I

Characteristics of the Sample (559 Enlisted
Members of the Marine Corps Reserve)

	Mean	Standard deviation
Age (in years)	21.71	4.34
Education (in years)	11.39	1.42
Intelligence (AGCT score)	105.76	10.18
Drill attendance (% of drills attended).	75.33	27.34
Conduct Rating (officers' rating) . . .	4.33	.47
Proficiency rating (officers' rating). .	3.96	.59
Marksmanship M1 (last qualification score)	199.64	19.94

Rank (proportion of total who are privates)   67%

II. SUMMARY OF RESULTS

SUMMARY OF RESULTS

Six characteristics were found to be related to marksmanship. They were age, education, intelligence, conduct, general proficiency and military rank. None of the relationships was large enough to explain the variation in marksmanship scores among Reservists.

A special analysis among privates and non-commissioned officers showed that background characteristics are more strongly related to marksmanship among privates than among non-commissioned officers.

III. THE ANALYSIS AND RESULTS FOR THE TOTAL SAMPLE

A. The Relationship to Marksmanship of Age, Education, Intelligence, Attendance, Conduct and General Proficiency.[*]

The personal characteristics of age, education and intelligence, and the performance characteristics of attendance, conduct and general proficiency were correlated with marksmanship by means of the Pearson Product Moment Correlation.[**] The correlations are shown in column two of Table II which follows. To test the significance of the correlations, each correlation was transformed to the z statistic[***] which is shown in column three of Table II. The significance of the correlation as measured by the z transformation is shown in column four of Table II.

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[*] Since Rank was a dichotomous attribute and therefore not amenable to the correlation analysis used, it was analyzed by a different statistic, as reported in the third part of this section.

[**] The formula used for calculating the Pearson Product Moment Correlation was:

$$r = \frac{N \sum XY - \sum X \sum Y}{\sqrt{N \sum X^2 - (\sum X)^2} \; \sqrt{N \sum Y^2 - (\sum Y)^2}}$$

where: r = the Pearson Product Moment Correlation
        N = number of subjects
        X = score in one characteristic
        Y = score in the second characteristic

[***] A discussion of the r to z transformation will be found in Quinn McNemar, Psychological Statistics, Fourth Printing, New York, John Wiley and Sons Inc., 1949, pp. 123-4.

TABLE II

The Correlation of Personal and Performance Characteristics
with Marksmanship, the Significance of the Correlations and
the Degree to which They Contribute to the Variability of
Marksmanship Scores. (n = 559)

Variables correlated with marksmanship	Pearson Product Moment Correlations	Transformation	Significance of correlation (2 tailed test)	Contribution of variable to variation in marksmanship score
Age	.30	.309	.001	.090
Education	.20	.203	.001	.040
Intelligence	.26	.266	.001	.068
Attendance	.07	.070	.099	.049
Conduct	.36	.377	.001	.130
Proficiency	.20	.203	.001	.040

* The contribution of a variable to the variance of marksmanship is
found by squaring the correlation.

Five of the six correlations (all except the correlation of attendance and marksmanship) are significant at the .001 level. That is, they could not happen more than one time in 1000 on a chance basis alone. Thus, these five variables - age, education, intelligence, conduct and proficiency - are significantly related to marksmanship.

None of the five, however, contributes very much to the variation in marksmanship scores. Conduct, which contributes the most to variation in marksmanship, only affects .13 or 13% of the variance. Thus, none of the five variables which were significantly related to marksmanship was a determinant of marksmanship.

Another way to state this result is to say that five of the six variables are related to marksmanship but none of them is closely enough related to serve as a predictor of marksmanship.

2. The Combined Relationship of Age, Education, Intelligence, Attendance, Conduct and General Proficiency with Marksmanship

While none of the personal or performance characteristics was a determinant of marksmanship when taken singly, it was hypothesized that they might serve as a predictor when taken as a collective battery.

To test this possibility, a multiple correlation between the six characteristics and marksmanship was calculated by means of the Doolittle Method.[*] Table III shows the Pearson Product Moment Correlations used to calculate the Multiple Correlations.

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[*] Ibid., pp. 157-160.

TABLE III

The Correlation Matrix Used in Calculating the Multiple
Correlation of Age, Education, Intelligence, Attendance,
Conduct and Proficiency with Marksmanship[*]

	Age	Education	Intelligence	Attendance	Conduct	Proficiency	Marksmanship
Age		.13	.08	.10	.48	.46	.30
Education			.46[**]	.06	.24	.11	.20
Intelligence				.18	.18	.17	.26
Attendance					.11	.13	.07
Conduct						.50	.36
Proficiency							.20

The multiple correlation was .44, and significant at the .001 level.[***]
But the multiple correlation only explains .194 or 19.4% of the
variation in marksmanship scores.[****] Hence the battery of six items
was not a determinant of marksmanship. In fact, the battery of
characteristics is related to marksmanship only a little more closely
than conduct, the single characteristic with the highest correlation.

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[*] Each cell entry is the Product Moment Correlation based on 559 cases.

[**] Ordinarily a higher correlation than .46 would be expected between
Intelligence and Education, but a large part of the sample have not
yet completed their education. This makes the correlation lower
than it would be in an older population.

[***] The significance of the Multiple correlation was estimated by Formula
74, Ibid., p. 160

[****] The contribution which a battery of items makes to the variance of
another item is estimated by squaring the multiple correlation.

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As the multiple correlation is the maximum correlation that can be obtained from these six characteristics with marksmanship, it may safely be concluded that these variables singly or in any combination are not determinants of marksmanship.

C. Rank and Marksmanship

Rank was dichotomized into private (private first class and private) and non-commissioned officer (corporal and sergeant.) A correlation ratio[*] of rank and marksmanship was then calculated. The value of the correlation ratio was .36. This correlation ratio is significant at better than the .01 level, which means that this correlation ratio could occur less than one time in one hundred on a chance basis alone.[**] Thus, it may be inferred that rank is significantly related to marksmanship. The basic parameters used in calculating the correlation ratio are given in Table IV.

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[*] For the method used in calculating the correlation ratio and a discussion of this statistic see C. C. Peters and W. R. Van Voorhis, _Statistical Procedures and Their Mathematical Bases_, First Edition, New York, McGraw-Hill Book Company, Inc., 1940, pp. 319-24.

[**] Ibid., pp. 324-5

TABLE IV

The Means and Variances Used in Calculating the
Correlation Ratio of Rank With Marksmanship

	Privates	Non-Com-missioned Officers	Total Sample
Number of Cases	373	186	559
Average Marksmanship score.	195.37	208.81	199.84
Variance of the Marks-manship Scores	444.37	172.92	397.60

A correlation ratio of .36 means that rank contributes only .13 or 13% to the variation in marksmanship scores. Thus rank could not be considered a determinant of marksmanship.

D. Conclusion

Age, education, intelligence, conduct, performance and rank are all significantly related to marksmanship. None of them contributes 50% to the variation in marksmanship scores. As a result, none of them is considered a determinant of marksmanship.

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IV.   A SPECIAL ANALYSIS FOR NON-COMMISSIONED OFFICERS AND PRIVATES

During the course of the regular analysis, correlations of each of age, education, intelligence, attendance, conduct and general proficiency with marksmanship were calculated for privates and for non-commissioned officers separately. These correlations are shown in Table V.

TABLE V

The Pearson Product Moment Correlations of Age, Education, Intelligence, Attendance, Conduct and General Proficiency With Marksmanship Among Privates and Among Non-Commissioned Officers

| | Pearson Product Moment Correlation | |
Variable correlated with marksmanship	Among Privates	Among Non-commissioned Officers
Age	.16	.10
Education	.18	.09
Intelligence	.29	.08
Attendance	.05	.10
Conduct	.17	.24
Proficiency	.08	.25

It was observed that the correlations of each of the three personal characteristics, age, education and intelligence with marksmanship were higher among privates than among non-commissioned officers, while the

correlations of each of the three performance characteristics, attendance, conduct and proficiency were higher among non-commissioned officers than among privates.

To test this observation, multiple correlations of the three personal characteristics with marksmanship and the three performance characteristics with marksmanship were calculated separately for privates and for non-commissioned officers.

The correlation matrix used for calculating each of the four multiple correlations is given in Table VI.

The multiple correlation of the three personal characteristics with marksmanship was .33 for privates and .15 for non-commissioned officers. The difference of .18 between these correlations is significant at the .021 level. Thus it may be concluded that personal characteristics are more strongly related to marksmanship among privates than among non-commissioned officers.

The multiple correlation of the three performance characteristics with marksmanship was .27 among non-commissioned officers while among privates it was .14.

TABLE VI

The Correlation Matrices Used in Calculating the Multiple
Correlation of Background Characteristics and Marksman-
ship and Performance Characteristics and Marksmanship for
Privates (n = 373) and for Non-Commissioned Officers (n = 186)

		Education	Intelligence	Marks-manship		Conduct	Gen. Prof.	Marks-manship
Non-Com-missioned Officers	Age	-.11	-.08	.10	Attendance	.17	.30	.10
	Education		.52	.09	Conduct		.67	.24
	Intelligence			.08	Gen. Prof.			.25
Privates	Age	.05	.06	.16	Attendance	.06	.07	.05
	Education		.41	.18	Conduct		.35	.17
	Intelligence			.29	Gen. Prof.			.08

The difference of .13 between these is significant at the .061 level.
Thus, while the relationship is larger among non-commissioned officers,
it does not reach the .05 level which was used in this study.

To sum up, personal characteristics of age, education and intelligence
are more strongly related to marksmanship among privates than among non-
commissioned officers.

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This may be explained by the differences in amount of military training: the marksmanship of privates, who have had very little military training, will be more affected by their capacities and experience -- in particular the ability to learn quickly -- than will the non-commissioned officers, who have had more military training. In other words, the effect of general capacities and experience on marksmanship is decreased as military training is increased.